

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. (Amended) An apparatus for monitoring a structure and for locating the position of an event including;

5

a light source;

a waveguide for receiving light from the light source so that the light is caused to propagate in both directions along the waveguide to thereby provide counter-propagating optical signals in the waveguide, the waveguide being capable of having the counter-propagating optical signals or some characteristic of the signals modified or effected by an external parameter caused by or indicative of the event to provide modified counter-propagating optical signals which continue to propagate along the waveguide; and

10

15

detector means for detecting the modified counter-propagating optical signals effected by the parameter and for determining the time difference between the receipt of the modified counter-propagating optical signals in order to determine the location of the event.

20

2. The apparatus of claim 1 wherein the waveguide is a silica waveguide.

25

3. The apparatus of claim 1 or 2 wherein light source is for launching simultaneously into opposite ends of the waveguide.

SUB  
AI 7

30

4. The apparatus of any one of claims 1 to 3 wherein the light source is a single light source.

5. The apparatus of any one of claim 1 to 4 wherein the waveguide is one or more optical fibres which forms an event sensitive optical fibre.

35

0957340-050401

SUB A1  
CONTD

6. The apparatus of any one of claims 1 to 5 wherein further silica waveguides are connected to the said waveguide at either or both ends in order to add

5

additional delay between the transmissive counter-propagating signals and to provide insensitive lead waveguides.

10

7. The apparatus of any one of claims 1 to 6 wherein the detector means comprises:

first and second photodetectors for simultaneously receiving the radiation from the counter-propagating signals in the waveguide; and

15

processing means for receiving signals from the first and second photodetectors for determining the time delay or difference between the signals effected from the same disturbance and therefore determining the location of the sensed event.

20

8. The apparatus of claim 7 wherein a waveguide, coupler or set of couplers is arranged between the light source and the photodetectors and the silica waveguide so that the light can be simultaneously transmitted from the light source to both ends of the silica waveguide and the detector means also being connected to the coupler or couplers so that the counter-propagating transmissive radiation can be directed via the coupler or couplers from the silica waveguide to the detector means.

30

9. The apparatus of any one of claims 1 to 8 wherein the waveguide is for connection to the structure to monitor the structure.

SUB  
A2

35

10. The apparatus of anyone of claims 1 to 8 wherein the structur comprises the waveguide for transmitting data along the waveguide from one place to another and the

04090" 04E25850

Sub  
A2  
cont'd.

waveguide simultaneously receiving the light from the light source to provide the counter-propagating optical signals so as to enable the integrity and security of the waveguide to be monitored.

5

11. The apparatus according to any one of claims 1 to 10 wherein the detector also identifies or quantifies the parameter from the modified counter-propagating optical signals.

10

12. The apparatus of any one of claims 1 to 11 wherein waveguide is arranged in a loop configuration so that light can be simultaneously launched into both ends of the waveguide from a single light source.

15

Sub  
Br

13. (Amended) The apparatus of claim 11 wherein data signals are supplied to the waveguide so that the waveguide acts as a communication link for transmission of data from one place to another and the launching of the counter-propagating optical signals in the waveguide enables the integrity and security of the waveguide to be monitored.

20

14. (Amended) The apparatus according to claim 11 wherein the waveguide is applied to a structure to monitor the structure.

25

15. (Amended) A method for monitoring a structure to locate the position of an event, including the steps of; launching light into a waveguide so that the light is caused to propagate in both directions along the waveguide to thereby provide counter-propagating optical signals in the waveguide, the waveguide being capable of having the counter-propagating optical signals or some characteristic of the signals modified or effected by an external parameter caused by the event, to provide modified counter-propagating optical signals which continue to propagate along the waveguide; and

30

35

detecting the modified counter-propagating optical signals effected by the parameter and for determining the time difference between the receipt of the modified signals in order to determine the location of the event.

5

16. The method of claim 13 wherein the light is launched into both ends of the waveguide to provide the counter-propagating signals.

Sub  
B9

10

17. The method of claim 13 wherein the light is launched into both ends of the waveguide from a single light source.

18. The method according to claim 11 wherein the parameter is quantified and/or identified from the modified signals.

15

19. (Amended) A waveguide transmissive counter-propagating signal method for locating events in optical waveguides, which may include:

ca

20

providing a sensing optical fibre formed from a waveguide material designed to simultaneously transmit counter-propagating optical signals;

providing a detector for locating events in optical waveguides,;

25

providing a lead optical fibre formed from a waveguide material which acts as an insensitive light guide between the sensing fibre and detector;

providing a lead optical fibre formed from a waveguide material which acts as an insensitive light guide between the sensing fibre and a light source;

30

connecting the sensor waveguide and the lead optical fibres so that cores of the waveguides are aligned and remain fixed at the splice;

35

launching counter-propagating light signals into the sensing optical fibre and lead optical fibres, which light signals are modified upon disturbance of the sensing

095740-06041



SUB A3 >

22. The apparatus of claim 20 or 21 wherein the light source is for launching simultaneously into opposite ends of the link.

5 23. The apparatus of any one of claims 20 to 22 wherein the light source is a single light source.

24. The apparatus of any one of claims 20 to 23 wherein the detector means comprises:

10 first and second photodetectors for simultaneously receiving the light from the counter-propagating signals in the link; and  
processing means for receiving signals from the first and second photodetectors for determining the time  
15 delay or difference between the signals effected from the same disturbance and therefore determining the location of the disturbance.

20 25. The apparatus of claim 24 wherein a waveguide coupler or set of couplers is arranged between the light source and the photodetectors and the link so that the light can be simultaneously transmitted from the light source to both ends of the link and the detector means also being connected to the coupler or couplers so that  
25 the counter-propagating signals can be directed via the coupler or couplers from the link to the detector means.

26. (Amended) A method for monitoring an optical fibre communication link into which data signals are launched  
30 and from which the data signals are received, to locate the position of a disturbance to the link, including the steps of;

35 launching light into the link so that the light is caused to propagate in both directions along the link to thereby provide counter-propagating optical signals in the link, the link being capable of having the counter-propagating optical signals or some characteristic of the

095740-05041

signals modified or effected by the disturbance to provide modified counter-propagating optical signals which continue to propagate along the link; and

5 detecting the modified counter-propagating optical signals effected by the disturbance and for determining the time difference between the receipt of the modified signals in order to determine the location of the disturbance.

10 27. The method of claim 26 wherein the light is launched into both ends of the link to provide the counter-propagating signals.

15 28. The method of claim 26 wherein the light is launched into both ends of the link from a single light source.

005540 0004

*add 1517*